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Original Research Paper

General surgery

TO EVALUATE THE OUTCOME OF CONVENTIONAL VERSUS NEGATIVE PRESSURE WOUND THERAPY

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ABSTRACT **Background:** Chronic wounds result in increased morbidity, prolonged stay in the hospital, and expenditure on health care. Conventional wound therapy using gauze or moist dressings is common practice. Negative Pressure Wound Therapy (NPWT) is a modern approach for effective wound healing with minimal complications.(Vikatmaa et al; 2008) **Aim:** To assess and compare the clinical outcomes between the conventional wound therapy and the negative pressure wound therapy for patients with acute and chronic wounds. **Methods:** This was a prospective comparative study, carried out at the Department of General Surgery, Krishna Mohan Medical College and Hospital, Mathura, over 18 months, starting in May 2024 and finishing in October 2025. A total of 50 patients, between 18 and 80 years of age, with traumatic wounds, high-risk incisions, chronic non-healing wounds, burns, ulcers, or surgical site infections, were included in the study. Random allocation was performed to either CWT or NPWT. Patients with severe peripheral vascular disease, full-thickness burns, existing necrotic eschars, exposed viscera or major vessels, malignancy in the wound bed, and complex fistulas were excluded. A polyurethane foam dressing with an occlusive drapes and continuous or intermittent cycles of negative pressure (range 75-125 mmHg) was utilized in NPWT. CWT was achieved with antiseptic-impregnated dressing changes, performed every 12 to 24 hours. The data analysis was performed with chi-square/Fisher's exact tests to determine categorical variables, while t-test and Mann-Whitney tests were used to study continuous data, taking $p < 0.05$ as statistically significant. **Results:** The demographic and clinical parameters such as age, sex, occupation, reason for injury, and side of injury were similar for both groups. NPWT had faster wound size reduction, formation of granulation tissue, and reduction in exudate scores for NPWT patients than for CWT patients from week 3 onwards. NPWT had faster wound bed preparation for grafting or closure, along with a faster time to healing for wounds. NPWT had lower incidence of infection for wounds or surgical site infection than CWT patients with a relative difference of around 40%. Pain for NPWT patients and satisfaction were lower than for CWT patients. NPWT though had higher costs for equipment and supplies, also had lower numbers of dressing changes, hospital stay for NPWT patients, and complications than CWT patients, thus making NPWT have better cost-effectiveness. **Conclusion:** NPWT was found to be better than CWT with reference to dynamics of wound healing, wound infections, patient comfort, and resource utilization in the long term in patients with a mix of acute and chronic wounds. CWT appears to be indicated in uncomplicated or low-risk wounds, although NPWT should be considered as a modality of choice in complex wounds, highly exudate-heavy, or high-risk wounds.

KEYWORDS : negative pressure wound therapy, conventional wound therapy, open wounds, wound healing, cost-effectiveness

INTRODUCTION

It is difficult to heal wounds like trauma defects, diabetic foot ulcers, pressure ulcers, venous leg ulcers, and high-risk post-operative wounds. Traditionally, repair is carried out with simple dressings with gauze rolls and moist wound dressings, which protect the wound and assist with exudate management. These modalities often involve a cycle of frequent and sometimes painful interventions with a potential risk of tissue damage.(Agarwal et al; 2019).

Negative Pressure Wound Therapy (NPWT), first used clinically by Argenta and Morykwas in 1997, uses sub-atmospheric pressure with the aid of a foam interface system. This helps in the removal of exudate, reduction of edema, improved perfusion, and macro and micro-deformation, thus enhancing granulation tissue formation and healing. Systematic reviews have indicated its efficacy in providing the same, or better, results compared with conventional dressing in the management of certain types of wounds. (Argenta et al; 1997)

Considering that complex wounds are a continuing source of a high disease burden in general surgical practice, a study was conducted to investigate and directly compare the efficacy of conventional wound therapy versus NPWT in a tertiary institution.

AIM:

To evaluate the outcome of conventional versus negative pressure wound therapy and analyze the results with respect to healing parameters, complications, and implications for quality of life and resource use.

MATERIALS AND METHODS

Study Design And Setting

This was a prospective comparative study conducted in the Department of General Surgery, Krishna Mohan Medical College and Hospital, Mathura, a tertiary care center catering to both rural and urban populations in Uttar Pradesh. The study period was 18 months (May 2024–October 2025). Ethical approval was obtained from the Institutional Ethics Committee, and written informed consent was taken from all participants.

Study Population And Sample Size

A total of 50 patients were enrolled based on a priori sample size calculation assuming 80% power, 5% significance level, and an anticipated clinically relevant difference in healing outcomes between groups. Patients were divided into two equal groups:

Group A (Conventional Wound Therapy; CWT): n = 25

Group B (Negative Pressure Wound Therapy; NPWT): n = 25

Inclusion Criteria

- Age 18–80 years
- Traumatic wounds and high-risk surgical incisions
- Chronic wounds with delayed or impaired healing
- Surgical site infections and dermatofasciotomy wounds
- Acute burns and scalds, leg ulcers, and diabetic foot ulcers

Exclusion Criteria

- Age < 18 or > 80 years
- Full-thickness burns
- Severe peripheral arterial disease
- Necrotic wounds covered fully by eschar

- Wounds with exposed major blood vessels, nerves, or viscera
- Wounds adjacent to vascular anastomoses or the vagus nerve
- Malignant wounds (except in strictly palliative settings)
- Non-enteric or unexplored fistulas

Interventions

Conventional Wound Therapy (CWT):

- Routine wound cleansing with antiseptic solutions and normal saline irrigation
- Dressing with sterile gauze and bandages
- Dressing changes once or twice daily depending on exudate
- Systemic antibiotics, analgesics, and supportive therapy as per the treating surgeon

Negative Pressure Wound Therapy (NPWT):

- Wound bed preparation with debridement as needed
- Application of sterile polyurethane foam tailored to the wound bed
- Sealing with an adhesive occlusive drape to create an air tight environment
- Connection to a vacuum pump delivering continuous or intermittent negative pressure (75–125 mmHg) depending on wound characteristics
- Dressing changes every 48–72 hours, with close monitoring for bleeding, maceration, or device malfunction

These parameters are consistent with established NPWT protocols and prior clinical experience.

Outcome Measures

Primary Outcomes

Rate of wound healing as assessed by:

o Percentage reduction in wound area and depth over time

o Time to adequate wound bed preparation for grafting or closure

o Overall time to wound closure (spontaneous, graft, or flap)

Secondary Outcomes

- Quality of wound bed (conversion from slough to healthy red granulation)
- Exudate levels (graded scores over weekly follow-up)
- Infection and surgical site infection rates
- Pain scores during and between dressing changes (Visual Analog Scale)
- Length of hospital stay
- Need for additional procedures (re-debridement, re-operation)
- Patient satisfaction and functional mobility
- Comparative resource utilization and cost implications (dressing frequency, device use, hospital days, and complication-related interventions)

Patients were followed for the duration of inpatient care and until wound closure or completion of planned follow-up.

Statistical Analysis

Data were analyzed using SPSS version 24.0 (IBM, USA). Categorical variables (e.g., sex, wound type, occurrence of infection) were summarized as frequencies and percentages and compared using Pearson's chi-square or Fisher's exact test as appropriate. Continuous variables (e.g., wound healing time, pain scores) were expressed as mean ± standard deviation and compared using independent-samples t-test for normally distributed data or Mann–Whitney U test for non-normal data. A p-value < .05 was considered statistically significant.

RESULTS

Baseline Characteristics

Fifty patients were enrolled in the study, 25 in each group. Most participants were aged between 31–60 years, reflecting the economically active segment of the population. The age distribution was similarly distributed among the two groups, not significantly skewed towards either younger or older patients.

Men slightly predominated overall, about 60%, but showed a similar sex distribution in the CWT and NPWT arms. Occupational categories were equally distributed, including laborers, farmers, housewives, students, and others, indicating similar physical activity and socioeconomic backgrounds. Wound laterality was balanced, right versus left side.

Road traffic accidents were the leading mode of injury, followed by falls from height and machine/cut injuries, while burns and scalds presented the smallest subgroup. Distribution of these etiologies was similar between CWT and NPWT, confirming successful randomization and clinical comparability at baseline.

Wound Healing Dynamics

NPWT performance in terms of wound healing was significantly better when compared to CWT results. The wound area and depth decreased significantly earlier and more dramatically in NPWT wounds when compared to CWT wounds. Transformation of wound tissue to healthy red tissue was significantly faster in NPWT wounds, especially after week 3.

Serial assessment of exudate scores showed that, while exudate levels were initially high, they reduced faster in the NPWT group with a sharp divergence from week 3 until week 9, a feature of continuous fluid evacuation and reduction in edema as promoted by NPWT—a feature that is mechanistic and clinical in nature.

Infection And Other Complications

The incidence of wound infection and surgical site infection was lower in the NPWT group, with an approximate 40% relative reduction compared with conventional therapy, consistent with literature reporting decreased infection rates and complications under NPWT in high-risk wounds and open fractures. NPWT also reduced the need for repeated debridement and secondary procedures, though a small number of device-related adverse effects (e.g., minor skin irritation) were observed, all manageable with local care and adjustment of dressings.

Pain, Comfort And Length Of Hospital Stay

In patients receiving NPWT, pain scores at dressing change were lower, reflecting fewer dressing events and reduced trauma to the wound bed compared with daily gauze removal. Functional mobility and overall satisfaction scores were higher with NPWT; this is consistent with prior reports that NPWT can improve patient-reported outcomes when appropriately managed.

Hospital stay was shorter in the NPWT group, due to quicker stabilization of wounds and lesser complications. This is compatible with several randomized trials and meta-analyses that have shown less time to closure and shorter inpatient stays with NPWT compared to standard dressings in selected wound types.

Cost And Resource Utilization

Although the daily cost of NPWT (device, foam, canisters) was much higher than that of the gauze-based CWT, total resource utilization advantageous for NPWT resulted because:

Fewer dressing changes and reduced nursing time requirements

Shorter duration of hospitalization

Reduced requirement for unplanned procedures, such as prolonged antibiotic treatments

These factors combined will enhance cost effectiveness, in line with health economic analysis to support NPWT, where it is considered to be either cost saving or at least cost neutral when indirect costs and expense related to complications are taken into account.

DISCUSSION

This prospective comparative study shows that NPWT is superior to conventional wound therapy when a variety of outcome measures of clinical relevance are assessed for a population of mixed acute and chronic wounds. NPWT increased the rate of wound size reduction, tissue granulation, exudate and infection reduction, hospital stay, patient comfort, and patient satisfaction despite increased initialresource costs.

These observations are in line with the earlier work of Argenta and Morykwas who described the use of sub-atmospheric pressure via foam in improving perfusion, reducing edema, and providing granulation tissue formation via macro and micro deformation effects. Similarly, studies in the form of systematic reviews have found that the NPWT is at least as good or better in the treatment of complex wounds such as chronic ulcers, wounds resulting from trauma, and even fractures. (Liu et al; 2018)

These current results also support recent findings that NPWT can aid in decreasing the incidence of infections and complications and enhance wound healing for open fractures and surgical wounds, as well as enhancing cost-effectiveness at a system-wide level. It is also important to note that the results were generated in a "real world" environment within a general surgery setting within a resource-constrained area.

From a pathophysiological viewpoint, the advantages of NPWT over CWT in this cohort are explained by:
Continuous exudate and interstitial oedema control to prevent maceration and enhance oxygen delivery

Improved local blood flow and angiogenesis at wound edges

Mechanical stimulation of fibroblasts and extracellular matrix deposition

Reduced bioburden via closed suction and fewer dressing disruptions - Agarwal et al. 2019

These mechanisms taken together explain early granulation and readiness of wounds in the NPWT arm.

Despite its strengths, this study has limitations. The sample size (n = 50) is modest, limiting subgroup analyses by specific wound etiology or comorbidity (e.g., diabetic vs non diabetic ulcers). The follow-up period focused on time to closure and early outcomes; longer-term recurrence, functional recovery, and cosmesis were not systematically evaluated. While randomization and standardized protocols were used, complete blinding was not feasible. Finally, cost analysis was based on direct hospital metrics and did not capture broader societal costs.

Nevertheless, when interpreted within the context of higher powered randomized studies or systematic reviews, they underscore an emerging consensus that NPWT should be used primarily for complex, high-risk, or heavily exudating wounds, whereas CWT should be reserved for simple, low-risk wounds or when NPWT access is not currently available. (Burhan et al; 2022)

CONCLUSION

Negative pressure wound therapy significantly improved wound healing dynamics, decreased levels of wound infections and complications, reduced hospital stay, and increased patient comfort and satisfaction when compared to a more conventional gauze-based wound therapy approach, as well as being cost effective. NPWT should now be regarded as a preferred option in the management of complex acute and chronic wounds within general surgical practice; however, it is imperative that resources and expertise are available. Although there is still a place for more conventional wound therapy, particularly for uncomplicated wounds and for use within resource-poor environments, there is now additional supporting evidence for the use of NPWT for high risk wound patient populations.

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